PATENT SPECIFICATION

Application Date: May 13, 1943. No. 7630/43. 565,309

Complete Specification Left: March 17, 1944.

Complete Specification Accepted: Nov. 6, 1944.

PROVISIONAL SPECIFICATION

Improvements in or relating to Devices for Indicating and/or Controlling a Predetermined Level of Liquid in a Container

We, THE BRITISH THERMOSTAT COMPANY LIMITED, a British Company, and JOHN EDWARD SHERLOCK, a British subject, both of Teddington Works, Windmill Road, Sunbury-on-Thames, Middlesex, do hereby declare the nature of this invention to be as follows:—

This invention relates to devices for indicating or controlling a predetermined level of liquid in a container, such as the level of water in a boiler, and has for its object to provide an improved thermostatically operated arrangement for this purpose which is capable of acting as an indicator or to operate such components as pumps, valves or alarm devices.

According to the invention the improved devices for indicating and/or controlling a predetermined liquid level in a container comprise expansible metallic elements one of which is adapted to be heated and both of which are disposed within a container wherein the liquid level is liable to vary, the said elements being arranged to actuate switch mechanism for indicating or operating purposes.

In carrying the invention into effect and in the preferred manner the arrangement for indicating and/or controlling a predetermined level of liquid in a container comprises two parallel tubes of readily expansible metal, for example aluminium, which are fixed at one end in a common support and at the opposite end are movably mounted in guides constructed to allow expansion and contraction of the tubes. Within one of the tubes which occupies the lower position is mounted an electrical heating element and within each tube is mounted a push rod formed of a metal which has an almost negligible co-efficient of expansion.

A suitable metal for this purpose is the nickel alloy known under the Registered Trade Mark "Invar". These push rods are arranged to butt against closed ends of the tubes which pass through the guides and to project through the opposite fixed ends of the tubes and engage recesses formed in elements forming part of an electrical switching mechanism. This switch mechanism comprises a pivoted rocking lever whose ends carry parallel arms formed with the said recesses engaged by the ends of the push rods. The ends of the arms remote from the push rods carry means for operating an axially movable switch element forming part of a switching device carried in a bracket mounted on the support in which the ends of the expansible tubes are fixed and which support may conveniently form one end wall of the liquid container.

The said arms are maintained in engagement with the ends of the push rods, which project through to the exterior of the said support, by mounting the pivot of the rocking lever in a slidable component of the bracket urged by a spring in a direction towards the ends of the tubes.

A casing adapted to be mounted on the said support or end wall normally encloses the components of the switching mechanism.

In the operation of the device described, the heater enclosed within the lower of the two tubes is in constant operation. So long as the tubes are covered with liquid, the heated tube is cooled by conduction and convection so that there is comparatively little difference of temperature between the two tubes. Should the liquid level fall, however, and leave the tubes uncovered, the temperature of the heated tube rises sharply owing to the fact that the gas or vapour above the liquid has much less cooling power than the liquid. The consequent expansion of the heated tube, which is not balanced by a corresponding expansion of the unheated tube causes one push rod to move. The pressure of the spring forcing the ends of the parallel arms onto the ends of the push rods, then causes rocking movement of the lever and arms and actuation of the switch to make or break the electrical circuit according to the nature of the signal or control required.

Expansion or contraction of the heated tube due to variation in the liquid temperature is compensated by equal expansion or contraction of the other

[Price 1/-]

tube and the instrument is, therefore, unaffected by variations of ambient temperature.

The switch operating members carried by the parallel arms are of sufficient area to enable them to maintain contact with the ends of the axially movable switch operating element irrespective of variations in position of the rocking lever and arms due to the action of the spring when the axial positions of the push rods vary.

Dated this 13th day of May, 1943.
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London. E.C.4.

COMPLETE SPECIFICATION

Improvements in or relating to Devices for Indicating and/or Controlling a Predetermined Level of Liquid in a Container

We, THE BRITISH THERMOSTAT COMPANY LIMITED, a British Company, and JOHN EDWARD SHERLOCK, a British subject, both of Teddington Works, Windmill Road, Sunbury-on-Thames, Middlesex, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to devices for indicating or controlling a predetermined level of liquid in a container, such as the level of water in a boiler, and has for its object to provide an improved thermostatically operated arrangement for this purpose which is capable of acting as an indicator or to operate such components as pumps, valves or alarm devices.

According to the invention the improved devices for indicating and/or controlling a predetermined liquid level in a container comprise expansible metallic elements, one of which is adapted to be electrically heated and both of which are disposed within a container wherein the liquid is liable to vary, the said elements being arranged in opposition to actuate switch mechanism for indicating or operating purposes when the heated element is uncovered by the liquid.

According to the preferred form of the invention a device for indicating and/or controlling a predetermined liquid level comprises expansible metallic elements each of which is mounted co-axially with a non-expansible push rod within a liquid container, a switch-actuating device engaged by both push rods acting in opposition and means for electrically heating one of said expansible elements for the purpose of causing operation of said switch-actuating device when unequal expansion of said elements occurs due to a fall in liquid level.

Reference will now be made to the accompanying drawings which illustrate an apparatus according to the invention and in which:—

Fig. 1 is a sectional elevation,
Fig. 2 is a sectional plan, and
Fig. 3 is an end elevation.

In the construction illustrated the improved apparatus comprises a casing 1 having fixed thereon tubular connecting members 2 and 3 to enable the casing to be placed in free communication with the boiler or other container, the liquid level wherein is to be indicated or controlled. Within the casing 1 are mounted two parallel tubes 4 and 5 made of a readily expansible metal, for example brass, these tubes being fixed at one end in a common support 6 forming an end wall of the housing 1 and at the opposite end being movably mounted in guides 7 forming part of a metal bracket 8 fixed to the second end wall 9 of the casing 1. The guide members 7 are of such dimensions as to allow free expanding and contracting movements of the tubes 4 and 5.

Within the tube 5 which occupies the lower position is mounted an electric heating element 10 of cylindrical form arranged co-axially within the tube. Within the tubes are mounted push rods 11 and 12 formed of a metal which has an almost negligible co-efficient of expansion, a suitable metal for the purpose being the nickel-alloy known under the Registered Trade Mark "Invar". The push rods 11 and 12 are arranged to butt against closures 13 and 14 at the ends of the tubes 4 and 5 and to project through the opposite fixed ends of the tubes where they engage recesses 15 in elements forming part of an electric switch mechanism.

The switch mechanism is enclosed within a casing 16 which is fixed to a flange 17 forming part of the end wall 6 of casing 1 and encloses also screw threaded plugs 18 which secure the fixed ends of tubes 4 and 5 in position. The switch mechanism comprises a rocking lever 19 (Fig. 2)

adapted to move about a pivot 20 and formed integral with brackets 21 formed with parallel arms 22, the inner ends of which are formed with the recesses 15 engaged by the push rods 11 and 12. The ends of arms 22 remote from the push rods carry adjustable elements 23 for operating an axially movable switch element 24 forming part of a switching device 25 carried in a bracket 26 mounted on a support 31 fixed to the wall 6, as shown in Fig. 2, by screws 32. The wall 6 may constitute the wall of the liquid container to which the apparatus is applied. The arms 22 are maintained in engagement with the ends of the push rods 11 and 12 by mounting the pivot 20 of the rocking lever 19 in a slidable component 27 of the support 31 which is urged by a spring 28 in a direction towards the ends of the tubes 4 and 5. Within the casing opening 16 there are also mounted at 29 (Fig. 3) the terminal block for attachment of the conductors of the electric circuit controlled by the switch 25 and a second terminal block 30 for attachment of the electrical conductors for the heater 10.

In the operation of the device above described the heater 10 is arranged to be in constant operation. So long as the tube 5 is covered with liquid it is cooled by conduction or convection so that there is comparatively little difference of temperature between the two tubes 4 and 5. Should the liquid level fall, however, and leave the tubes 4 and 5 uncovered, the temperature of the heated tube 5 will rise sharply owing to the fact that the gas or vapour above the liquid has much less cooling power than the liquid. The consequent expansion of the heated tube 5 which is not balanced by a corresponding expansion of the unheated tube 4 enables the push rod 12 to move so that the pressure of spring 28 causes a rocking movement of lever 21 and arms 22 and actuation of the switch member 24 to make or break the electrical circuit controlled by the switch 25 according to the nature of the signal or control required.

Expansion or contraction of the heated tube 5 due to variation in the liquid temperature is compensated by equal expansion or contraction of the tube 4 and the instrument is, therefore, unaffected by variations of ambient temperature.

The switch operating members 23 carried by the parallel arms 22 are each of sufficient area to enable them to maintain contact with the ends of the axially movable switch operating element 24 irrespective of variations in the position of the rocking lever 21 and arms 22 due to the action of the spring 28 when the axial positions of the push rods 11 and 12 vary.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A device for indicating and/or controlling a predetermined liquid level comprising expansible metallic elements, one of which is adapted to be electrically heated, and both of which are disposed within a container wherein the liquid level is liable to vary, the said elements being arranged in opposition to actuate switch mechanism for indicating or operating purposes when the heated element is uncovered by the liquid.

2. A device for indicating and/or controlling a predetermined liquid level comprising expansible metallic elements each of which is mounted co-axially with a non-expansible push rod within a liquid container, a switch-actuating device engaged by both push rods acting in opposition and means for electrically heating one of said expansible elements for the purpose of causing operation of said switch actuating device when unequal expansion of said elements occurs due to a fall in liquid level.

3. A device according to Claim 1 or 2 wherein said expansible elements comprise metallic tubes each closed at one end which is movably mounted in a guide and open at the opposite end which is fixedly mounted in a support.

4. A device according to Claim 3 wherein the lower of the two tubes has an electric heating coil disposed within it.

5. A device according to Claim 3 or 4 wherein each of said tubes has an inextensible metallic push rod housed concentrically within it, one end of each push rod bearing against the closed end of the tube and the other end of each push rod projecting through the open end of the tube into engagement with a pivotally mounted switch actuating device.

6. A device according to Claim 5 including a pivotally mounted member having switch operating arms carrying means engaged by the ends of the push rods and maintained in such engagement by spring pressed means acting on the pivot of said switch-operating member.

7. A device according to Claim 6 wherein the said arms carrying means for operating an axially movable switch element forming part of a switching device carried in a bracket mounted on a support in which the pivot of the switch-actuating member is movably mounted.

8. A device according to Claims 1 to 7 or any of them wherein the expansible elements or tubes are adapted to be immersed in the liquid of a container or are

mounted in a housing freely communicating with said container and wherein the switch mechanism and its actuating means are enclosed by a housing separate from the first housing.

9. A device for indicating and/or controlling a predetermined liquid level comprising a casing adapted to be connected to a liquid container, two expansible metallic tubes in said casing each closed at one end and movable in guides, a heater mounted within one of said tubes, a push rod of inextensible metal mounted within each tube to abut against the closed end thereof and to project through the opposite open end, means for fixedly retaining the open ends of the tubes in a support, switch mechanism externally of said casing, a rocking switch actuating member in engagement with the ends of the push rods acting in opposition.

10. A device for indicating and/or controlling a predetermined liquid level constructed, arranged and adapted to operate as herein described with reference to the accompanying drawings.

Dated this 17th day of March, 1944.

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Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1944.

[This Drawing is a reproduction of the Original on a reduced scale.]

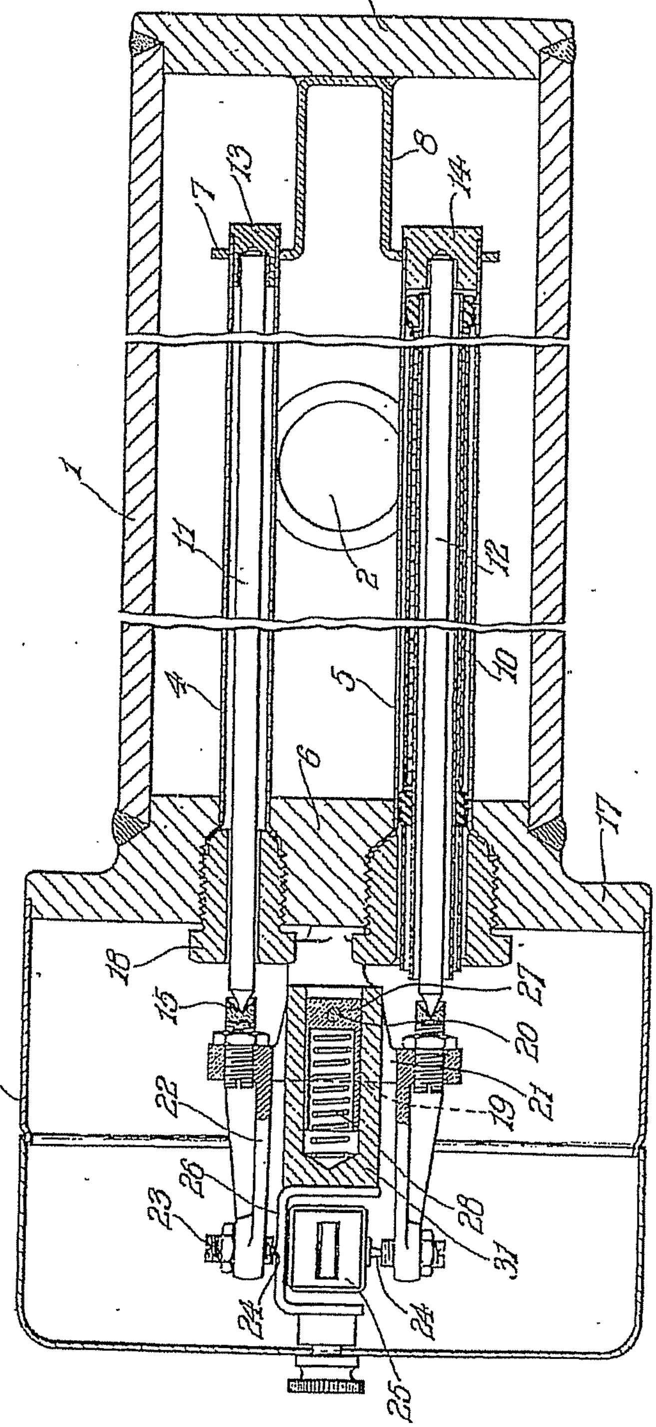

Fig. 1.

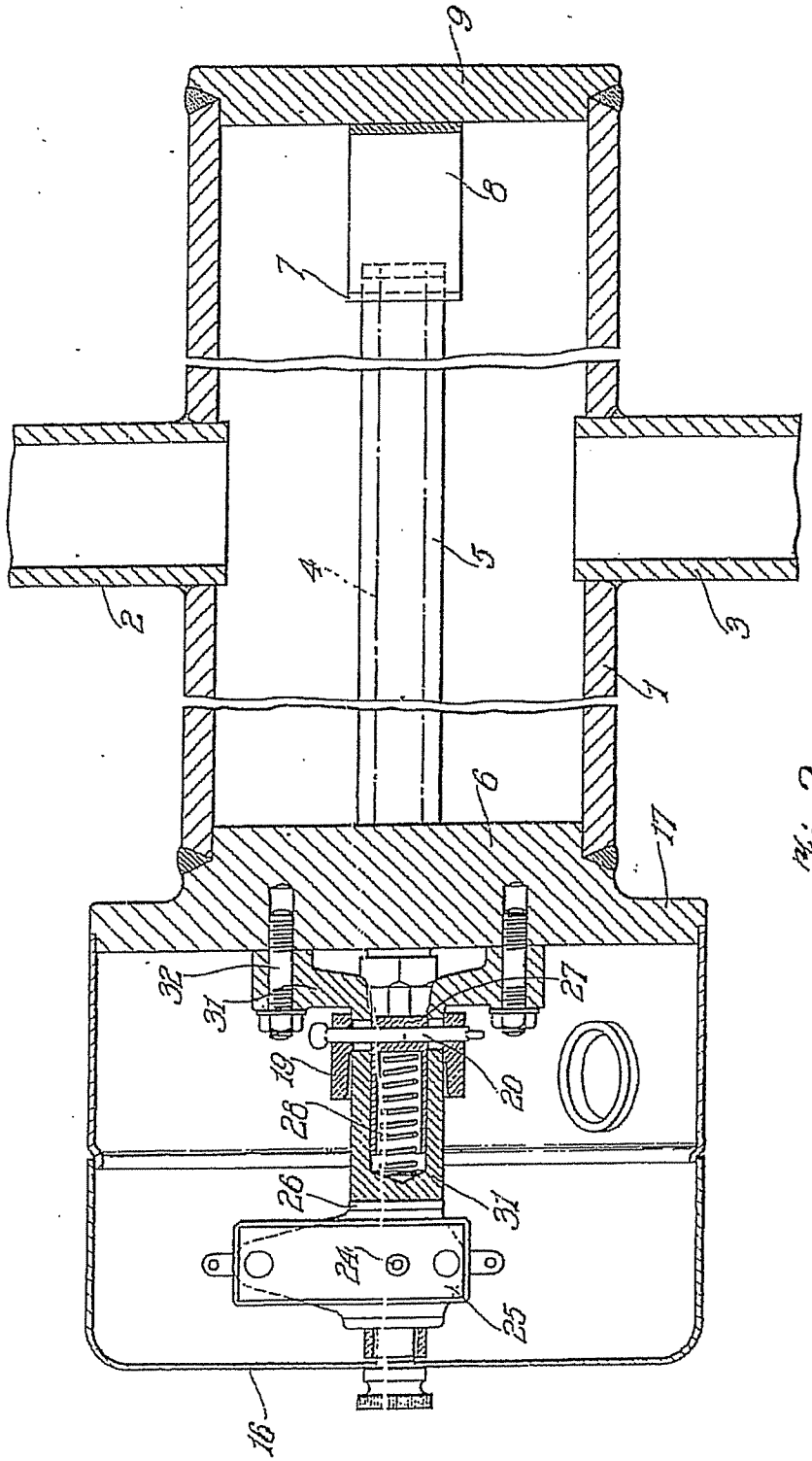

Fig. 2.

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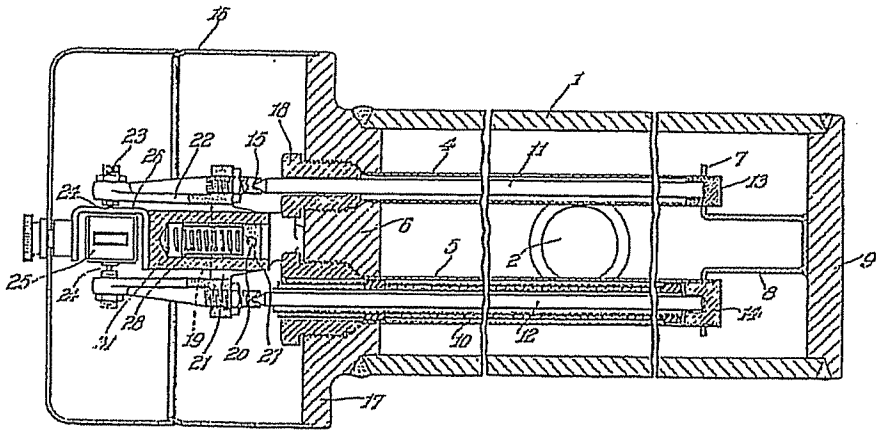

Fig.1.

SHEET 1

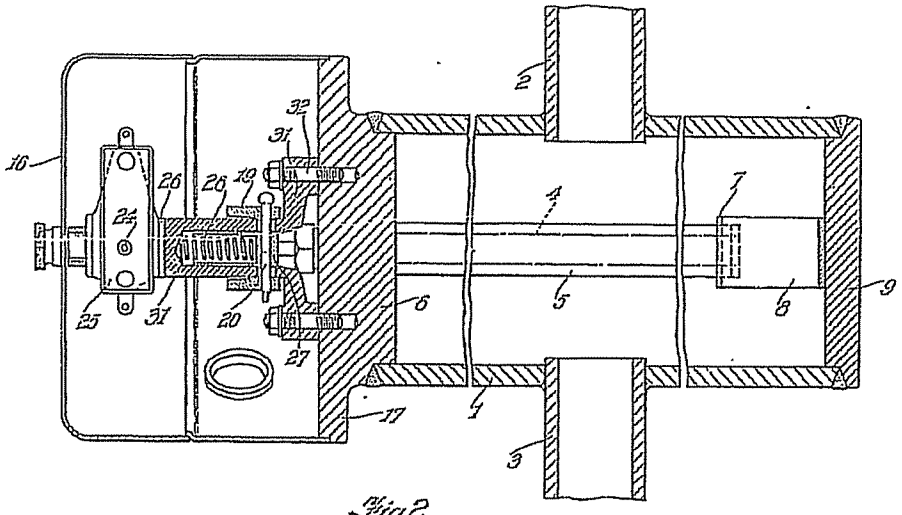

Fig.2.

3 SHEETS
SHEET 2

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[This Drawing is a reproduction of the Original on a reduced scale.]

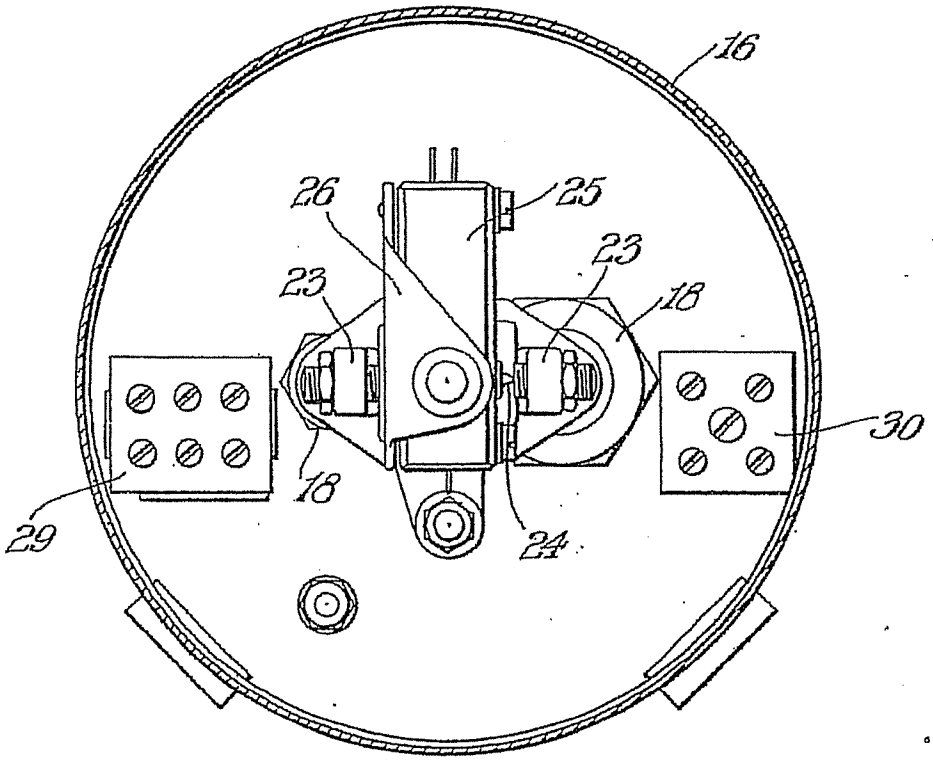

Fig. 3.

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